Lab 14

1. Show that TSP is NP-complete. (Hint: use the relationship between TSP and HamiltonianCycle discussed in the slides. You may assume that the HamiltonianCycle problem is NP-complete.)

2. Below is another variation of the Knapsack problem.
   Given a set S = $\{s_0, s_1, \ldots, s_{n-1}\}$ of items, weights $\{w_0, w_1, \ldots, w_{n-1}\}$, values $\{v_0, v_1, \ldots, v_{n-1}\}$, a max weight W, and a min value V, find a subset T of S whose total value is no less than V and total weight is at most W.

   Show that the SubsetSum problem is polynomial reducible to this Knapsack problem.

3. Show that the worst case for VertexCoverApprox can happen by giving an example of a graph G which has these properties:
   a. G has a smallest vertex cover of size *s*
   b. VertexCoverApprox outputs size 2*s as its approximation to optimal size.

4. The decision problem formulation of the Vertex Cover problem is this: Given a positive integer *k*, and a graph *G*, is there a vertex cover for *G* having size $\leq k$? Show that this decision problem belongs to *NP*.